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ABSTRACT

This document describes science benchmarks for grades K-8 in Earth and Space Science, Life Science, and Physical Science. Each subject area is divided into topics followed by a short content description and grade level information. Source documents for this paper included science content guides from California, Ohio, South Carolina, and South Dakota. This report intends to assist science instruction. (Contains 10 references.) (YDS)

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SEQUENCED BENCHMARKS FOR K–8 SCIENCE

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INTRODUCTION

PURPOSE

At the beginning of the standards movement in the early to mid-1990s, most states described standards content in broad grade bands of benchmarks or objectives, such as K–4, 5–8, and 9–12. As states have revised their standards, they have made them more specific, for example, K–2, 3–5, and 6–8. Some states have taken this process a step further by describing content for each level from kindergarten through 8th grade. A significant number of states, however, still do not provide such grade-by-grade distinctions in standards. Although this lack of specificity provides districts with some freedom to define the local curriculum, for many districts it presents an immediate problem. In order to implement standards, districts must find a way to translate these grade-range standards into meaningful benchmarks or objectives for day-to-day schooling at specific grades. Unfortunately, there has been little guidance available to districts as they undertake this process. Although documents produced by national subject-area organizations might be considered the highest authority in this regard, none provides grade-by-grade recommendations. It seems likely that these organizations were deterred by the lack of research supporting placement of content at specific grade levels. In addition, many organizations avoid the assignment of content to a grade because it is likely to be seen as overly prescriptive. Yet, the problem for a school district remains. Content must be assigned to a grade because it must be taught at a grade.

Although there is inadequate research support — and this will likely always be the case — to assign specific content definitively to a specific grade, there is information available about the sequence in which content should be presented in the curriculum. The American Association for the Advancement of Science (AAAS) has co-published *Atlas of Science Literacy* (2001) with the National Science Teachers Association. The *Atlas* comprises a series of conceptual strand maps that present students' growth in understanding, showing how the ideas and skills that students learn in different grades and topics depend on and support one another. The strand maps are based on an analysis of the content described in *Benchmarks for Science Literacy* (AAAS, 1993). The current report provides a somewhat different, though related approach. Like the *Atlas*, the report organizes benchmarks by topic. Rather than proposing a sequence of content organization based upon an analysis of each benchmark, this report describes the sequence of content that consistently appears among a set of highly-rated state standards. The report also includes information on the specific grades at which the content was placed within these documents. Simpler in scope than the *Atlas*, this report should nonetheless provide useful information for curriculum directors and others who must make choices regarding grade assignments for science content.

SOURCE DOCUMENTS

Two evaluation reports were used to help select the state documents used for the process of identifying the appropriate articulation of science content. One report was the American Federation of Teachers (AFT) *Making Standards Matter* (2001), which includes ratings of the state standards in terms of specificity and clarity. Another perspective on state standards was

published by the Fordham Foundation in the report *The State of State Standards in Science* (Lerner, 2000). Four of the state documents that were highly rated in both reports *and* that identify objectives at each grade, kindergarten through eighth grade, were selected as source documents:

California's Science Content Standards Grades K–12 (1998)
Ohio's Model Competency-Based Science Program (Draft 2001)
South Carolina Science Curriculum Standards (2000)
South Dakota Science Content Standards (June 1999)

METHOD

In order to track science content across these state documents, each of which varies in level of specificity and manner of content description, a uniform set of benchmarks was required for comparison. McREL's online standards database was used for this purpose. The database, the online equivalent of *Content Knowledge: A Compendium of Standards and Benchmarks for K–12 Education* (Kendall & Marzano, 2000), provides a synthesis of 137 standards documents representing 14 content areas.

In addition to a comparison set of benchmarks, it also was necessary to use a set of topics to organize this information. A topic is a level of organization that is more specific than a standard and organizes a set of benchmarks or objectives. Several topics are commonly found within a standard, and each topic organizes two or more benchmarks. The topic list used for this analysis was one developed at McREL for the online standards database (for a description of the process of topic development and samples in mathematics and language arts, see Kendall, 2000). The list of topics, organized by sub-discipline, is presented in Exhibit 1.

The articulation of benchmarks for each topic in this guide was developed entirely from the source documents specified above. Each document was reviewed for any *sequence information* it provided by topic. Sequence information is defined as the presence of a concept or skill in a grade that is topically related to a concept or skill in a higher or lower grade. That is, in any given document, two or more topic-related concepts must appear separated by at least one grade to be considered informative in the development of articulated content. Simply put, if two benchmarks addressing a given topic appeared in the same grade, it was inferred that the authors of the document did not consider the difference between content to be significant enough that the benchmark or objective should be in separate grades. If and when the presence of sequenced content was established in any one document, the same relative sequence — that is, the sequence of earlier to later grade — had to be supported by at least one additional document in order to be considered useful towards the articulation of content within the topic. The sequence of content also could not appear reversed in any other document. Thus, if an identified sequence showed concept A in an early grade and concept B in a later one in two separate documents, but in the reverse grade sequence in a third document, then the articulation was considered not established.

Once an articulation was established by sufficient evidence from the standards documents, the range of articulation was assigned based on grade information. For example, suppose one document placed a concept under a topic at grade 3 and the related concept at grade 5, and a

second document placed the same concept under grade 4 and the related concept at grade 6. In such a case, the first concept would be identified with the 3–5 grade range; the second, with 4–6.

Exhibit 1. Summary of Topics

Earth and Space Science	**Physical Science**
1. Characteristics of the Earth System 2. Earth's History 3. Earth's Surface Features 4. Energy in the Earth System 5. Motion of the Earth and Moon 6. Rocks, Minerals, and Soil 7. Seasons, Weather, and Climate 8. The Solar System 9. The Sun and Other Stars 10. The Universe 11. Water in the Earth System	18. Chemical Reactions 19. Conservation of Matter and Energy 20. Electricity and Magnetism 21. Energy Transfer and Entropy 22. Forces and Motion 23. Forms of Energy (Heat Energy) 24. Forms of Energy (Light Energy) 25. Position and Motion 26. Properties of Substances
Life Science	
12. Characteristics of Organisms 13. Diversity and Unity among Organisms 14. Interdependence of Organisms 15. Populations and Ecosystems 16. Relationships between Organisms and the Environment 17. Structure and Function in Organisms	

This means that, although both concepts could conceivably be addressed in grade 4 or both in grade 5, evidence supports the placement of the content in differing grades and somewhere within the specified grade ranges.

The product of this analysis is presented in 26 tables, each table representing the articulation of a topic that was supported by the evidence from state standard documents. There are 25 topics addressed (one topic – Forms of Energy – has more than one articulation of content). It should be noted that there are additional benchmarks appropriate for any given topic as well as those that appear in any given topic table. Each table lists only those benchmarks whose articulation could be supported by the documents. Similarly, there are many topics that are not articulated in this study because there was inadequate support. Of the 52 topics identified for the science standards in McREL's standards database, approximately 50 percent could not be articulated. However, the topics in this report represent the sequencing of 91 unique benchmarks; some benchmarks appear in more than one table because they were appropriate for more than one topic.

As Exhibit 2 exemplifies, for each table, the articulation supported by the documents is summarized in the far-left column by the grades at which the content may be placed; the column at the far right indicates at what grades and in which state the content was found. In a number of cases, the content is found in more than one grade in a given state standards document. In this case, each grade is listed, separated by a comma. The benchmarks in the center column are prefixed with a sequence number. In Exhibit 2, the two benchmarks at K–2 are identified as 1a and 1b. They are assigned the same number and are separated by a single vertical bar to indicate that there is insufficient information to indicate that one benchmark should appear at an earlier grade level than the other. The benchmarks after the K–2 band (that is, number 3 at grades 2–5 and number 4 at grades 6–7) are numbered consecutively and are each separated by a double bar to indicate that they should be placed consecutively. Appended to each benchmark in italics is the standard number, grade range, and order in which the benchmark appears in McREL's standards database.

Exhibit 2. Example of a Topic Table

Topic 12: Characteristics of Organisms

Grade Span	Benchmarks	Supporting Documents & Grade Level
Grades K–2	1a. Knows that plants and animals closely resemble their parents *Std 4, Gr K–2, Bmrk 1*	CA (2) OH (K) SC (K) SD (K)
	2a. Knows that differences exist among individuals of the same kind of plant or animal *Std 4, Gr K–2, Bmrk 2*	CA (2) OH (K) SC (K) SD (K)
Grades 2–5	3. Knows that many characteristics of an organism are inherited from its parents (e.g., eye color in human beings, fruit or flower color in plants), and that other characteristics result from an individual's interactions with the environment (e.g., people's table manners, ability to ride a bicycle) *Std 4, Gr 3–5, Bmrk 1*	CA (2) OH (4) SC (3,4) SD (5)
Grades 6–7	4. Knows that reproduction is a characteristic of all living things and is essential to the continuation of a species *Std 4, Gr 6–8, Bmrk 1*	OH (6) SC (6,7) SD (7)

It should be noted that for some topics the grade range noted in the far left column extends into high school. This is only the case when one of the source documents identifies the high school range as appropriate for the content addressed. In any event, none of the benchmarks articulated in this report appear later than the 8th grade in the McREL standards database.

How This Document Can Be Used

This document should prove useful for those districts and schools that seek to assign their state's grade range content to specific grades for instruction. It is likely that the topics in the tables that follow are addressed in nearly every state's science standards. Reviewing each topic in turn, users should compare the content to determine if it is addressed in their state's standards document. If it is, the treatment and grade range placement of content in the state document should be mapped against the topic in each table. This process will help users determine not only whether the significant aspects of the given topic are fully addressed in the state standards, but also how well the grade range placement accords with the standards documents used in this analysis. Having completed this rough mapping of content in a topic table to the state standards, users should consider the grades at which the same or similar content has been placed in the other state standards documents — information that is available in the far-right column of each table. This should at least help to narrow the grades for assignment, if not make clear at what the benchmark is commonly taught. Users of this document will want to consider the impact that grade placement might have on ensuring that standards continue to be aligned with their state standards, however. For example, if differing source documents indicate that given content could be placed at either fourth or fifth grade, and the user's own state standards place very similar content at the K–4 grade band, then fourth grade would be the stronger choice. Similarly, any information available about the assessment of science content should be part of the decision-making process. If science content is assessed in the fall of sixth grade, for example, the appropriate content should be placed in the prior grade so that students will have an opportunity to learn the material before being tested on it.

Once any one benchmark is assigned a grade, the user then should consider for placement those benchmarks that are positioned on either side of the given benchmark in the topic table — that is, those that precede and follow it — to determine whether they should be placed in the grade before or after the grade level of the benchmark. In similar fashion, the remaining topics should be reviewed for information that is available from the topic tables in the course of making grade placement decisions.

SUMMARY

It is difficult to imagine the research that could support the idea that specific content should be part of instruction in one grade as opposed to the grade just preceding or following it. There does appear to be some agreement, however, that certain concepts and skills can be articulated in a progression of understanding that helps students learn. This study identifies the articulation of content as it was found expressed in a number of highly-rated state standards documents. It also includes information about the grade levels at which they chose to assign content. It is hoped that educators who seek to make decisions about grade placement of content will find this information useful.

SEQUENCED BENCHMARKS

Topic 1: Characteristics of the Earth System

Grade Span	Benchmarks	Supporting Documents & Grade Level†
Grades K–1	1. Knows that Earth materials consist of solid rocks, soils, liquid water, and the gases of the atmosphere *Std 2, Gr K–2, Bmrk 1**	CA (K) OH (1) SC (K) SD (1)
Grades 2–5	2. Knows how features on the Earth's surface are constantly changed by a combination of slow and rapid processes (e.g., weathering, erosion, transport, and deposition of sediment caused by waves, wind, water, and ice; landslides, volcanic eruptions, earthquakes) *Std 2, Gr 3–5, Bmrk 1**	CA (4) OH (4) SC (3) SD (2,3,5)
Grades 6–8	3a. Knows that the Earth is comprised of layers including a core, mantle, lithosphere, hydrosphere, and atmosphere *Std 2, Gr 6–8, Bmrk 1**	CA (6) OH (6) SC (6) SD (6)
	3b. Knows how land forms are created through a combination of constructive and destructive forces (e.g., constructive forces such as crystal deformation, volcanic eruptions, and deposition of sediment; destructive forces such as weathering and erosion) *Std 2, Gr 6–8, Bmrk 2**	CA (6) SC (6,8)
Grades 6–12	4. Knows that the planet Earth and our Solar System appear to be somewhat unique (e.g., the Earth is the only celestial body known to support life), although similar systems might yet be discovered in the universe *Std 3, Gr 6–8, Bmrk 7**	CA (9–12) OH (6) SC (8)

† State standards document that supports proposed grade sequencing

* Benchmark reference: location within McREL's *Compendium* by standard, grade, and benchmark — available online at http://www.mcrel.org/standards-benchmarks/

Topic 2: Earth's History

Grade Span	Benchmarks	Supporting Documents & Grade Level†
Grades 2–3	1a. Knows that some kinds of organisms that once lived on Earth have completely disappeared (e.g., dinosaurs, trilobites, mammoths, horsetail trees) *Std 7, Gr K–2, Bmrk 1**	CA (3) OH (2) SD (2)
	1b. Knows that fossils provide evidence about the plants and animals that lived long ago and the nature of the environment at that time Std 2, Gr 3–5, Bmrk 5*	CA (2) SC (3)
Grades 6–8	2a. Knows that fossils provide important evidence of how environmental conditions have changed on the Earth over time (e.g., changes in atmospheric composition, movement of lithospheric plates, impact of an asteroid or comet) *Std 2, Gr 6–8, Bmrk 8**	CA (7) OH (6) SC (8) SD (8)
	2b. Knows that the fossil record, through geologic evidence, documents the appearance, diversification, and extinction of many life forms *Std 7, Gr 6–8, Bmrk 2**	CA (7) OH (6) SC (8) SD (6)
Grades 6–12	3. Knows how successive layers of sedimentary rock and the fossils contained within them can be used to confirm the age, history, and changing life forms of the Earth, and how this evidence is affected by the folding, breaking, and uplifting of layers *Std 2, Gr 6–8, Bmrk 7**	CA (7) OH (6) SC (9–12) SD (8)

† State standards document that supports proposed grade sequencing

* Benchmark reference: location within McREL's *Compendium* by standard, grade, and benchmark — available online at http://www.mcrel.org/standards-benchmarks/

Topic 3: Earth's Surface Features

Grade Span	Benchmarks	Supporting Documents & Grade Level†
Grades 3–4	1. Knows how features on the Earth's surface are constantly changed by a combination of slow and rapid processes (e.g., weathering, erosion, transport, and deposition of sediment caused by waves, wind, water, and ice; landslides; volcanic eruptions; earthquakes; drought) *Std 2, Gr 3–5, Bmrk 1**	CA (4) OH (4) SC (3) SD (3)
Grades 5–8	2a. Knows how land forms are created through a combination of constructive and destructive forces (e.g., constructive forces such as crystal deformation, volcanic eruptions, and deposition of sediment; destructive forces such as weathering and erosion) *Std 2, Gr 6–8, Bmrk 2**	CA (6) OH (6) SC (7,8) SD (6)
	2b. Knows that most of Earth's surface is covered by water, that most of that water is salt water in oceans, and that fresh water is found in rivers, lakes, underground sources, and glaciers *Std 1, Gr 3–5, Bmrk 4**	CA (5) OH (6,7) SC (6,7) SD (6)

† State standards document that supports proposed grade sequencing

* Benchmark reference: location within McREL's *Compendium* by standard, grade, and benchmark — available online at http://www.mcrel.org/standards-benchmarks/

Topic 4: Energy in the Earth System

Grade Span	Benchmarks	Supporting Documents & Grade Level†
Grades 1–3	1. Knows that the Sun supplies heat and light to Earth *Std 9, Gr K–2, Bmrk 1**	CA (3) OH (1) SC (1) SD (1)
Grades 5–7	2a. Knows that the Sun is the principal energy source for phenomena on the Earth's surface (e.g., winds, ocean currents, the water cycle, plant growth) *Std 1, Gr 6–8, Bmrk 3**	CA (6) OH (6) SC (7) SD (5)
	2b. Knows how the Sun acts as a major source of energy for changes on the Earth's surface (i.e., the Sun loses energy by emitting light; some of this light is transferred to the Earth in a range of wavelengths including visible light, infrared radiation, and ultraviolet radiation) *Std 9, Gr 6–8, Bmrk 4**	CA (6) OH (6) SC (7)

† State standards document that supports proposed grade sequencing

* Benchmark reference: location within McREL's *Compendium* by standard, grade, and benchmark — available online at http://www.mcrel.org/standards-benchmarks/

Topic 5: Motion of the Earth and Moon

Grade Span	Benchmarks	Supporting Documents & Grade Level†
Grades 1–3	1. Knows basic patterns of the Sun and Moon (e.g., the Sun appears every day and the Moon appears sometimes at night and sometimes during the day; the Sun and Moon appear to move from east to west across the sky; the Moon appears to change shape over the course of a month; the Sun's position in the sky changes through the seasons) *Std 3, Gr K–2, Bmrk 1**	CA (3) OH (2) SC (1) SD (1)
Grades 4–5	2a. Knows that night and day are caused by the Earth's rotation on its axis *Std 3, Gr 3–5, Bmrk 1**	OH (5) SC (4) SD (4)
	2b. Knows that the Earth is one of several planets that orbit the Sun and that the Moon orbits the Earth *Std 3, Gr 3–5, Bmrk 2**	CA (4) OH (5) SC (4) SD (4)
Grades 5–8	3a. Knows how the tilt of the Earth's axis and the Earth's revolution around the Sun affect seasons and weather patterns (i.e., light falls more intensely on one part or another of the Earth's surface during its revolution around the Sun) *Std 1, Gr 6–8, Bmrk 5**	CA (5) OH (7) SC (8) SD (6)
	3b. Knows how the regular and predictable motions of the Earth and Moon explain phenomena on Earth (e.g., the day, the year, phases of the Moon, eclipses, tides) *Std 3, Gr 6–8, Bmrk 2**	OH (6) SC (8) SD (6)

† State standards document that supports proposed grade sequencing

* Benchmark reference: location within McREL's *Compendium* by standard, grade, and benchmark — available online at http://www.mcrel.org/standards-benchmarks/

Topic 6: Rocks, Minerals, and Soil

Grade Span	Benchmarks	Supporting Documents & Grade Level†
Grade 2	1. Knows that rocks come in many different shapes and sizes (e.g., boulders, pebbles, sand) *Std 2, Gr K–2, Bmrk 2**	CA (2) OH (2) SD (2)
Grades 2–3	2. Knows the composition and properties of soils (e.g., components of soil such as weathered rock, living organisms, products of plants and animals; properties of soil such as color, texture, capacity to retain water, ability to support plant growth) *Std 2, Gr 3–5, Bmrk 4**	CA (2) OH (3) SC (3) SD (3)
Grades 2–8	3. Knows that smaller rocks come from the breakage and weathering of larger rocks and bedrock *Std 2, Gr 3–5, Bmrk 3**	CA (2) OH (6) SC (8)

† State standards document that supports proposed grade sequencing

* Benchmark reference: location within McREL's *Compendium* by standard, grade, and benchmark — available online at http://www.mcrel.org/standards-benchmarks/

Topic 7: Seasons, Weather, and Climate

Grade Span	Benchmarks	Supporting Documents & Grade Level†
Grade 1	1. Knows that the Sun provides the light and heat necessary to maintain the temperature of the Earth *Std 1, Gr 3–5, Bmrk 2**	CA (1) OH (1) SC (1) SD (1)
Grades 1–2	2. Knows that short-term weather conditions (e.g., temperature, rain, snow) can change daily, and that weather patterns change over the seasons *Std 1, Gr K–2, Bmrk 1**	CA (1) OH (2) SC (2) SD (2)
Grades 3–8	3a. Knows the processes involved in the water cycle (e.g., evaporation, condensation, precipitation, surface run-off, percolation) and their effects on climatic patterns *Std 1, Gr 6–8, Bmrk 2**	CA (5) OH (7) SC (6) SD (3)
	3b. Knows factors that can impact the Earth's climate (e.g., changes in the composition of the atmosphere; changes in ocean temperature; geological shifts such as meteor impacts, the advance or retreat of glaciers, or a series of volcanic eruptions) *Std 1, Gr 6–8, Bmrk 4**	OH (7) SC (6) SD (8)

† State standards document that supports proposed grade sequencing

* Benchmark reference: location within McREL's *Compendium* by standard, grade, and benchmark — available online at http://www.mcrel.org/standards-benchmarks/

Topic 8: The Solar System

Grade Span	Benchmarks	Supporting Documents & Grade Level†
Grades 3–5	1a. Knows that the Earth is one of several planets that orbit the Sun and that the Moon orbits the Earth *Std 3, Gr 3–5, Bmrk 2**	CA (3) OH (5) SC (4) SD (3)
	1b. Knows that planets look like stars, but over time they appear to wander among the constellations *Std 3, Gr 3–5, Bmrk 4**	CA (3) SC (4) SD (4)
Grades 5–7	2. Knows characteristics and movement patterns of the nine planets in our Solar System (e.g., planets differ in size, composition, and surface features; planets move around the Sun in elliptical orbits; some planets have moons, rings of particles, and other satellites orbiting them) *Std 3, Gr 6–8, Bmrk 1**	CA (5) OH (6) SC (6) SD (6,7)
Grades 5–8	3a. Knows characteristics and movement patterns of asteroids, comets, and meteors *Std 3, Gr 6–8, Bmrk 5**	CA (5) OH (8) SC (8) SD (6,7)
	3b. Knows that gravitational force keeps planets in orbit around the Sun and moons in orbit around the planets *Std 3, Gr 6–8, Bmrk 4**	CA (5) OH (8) SC (8) SD (7)

† State standards document that supports proposed grade sequencing

* Benchmark reference: location within McREL's *Compendium* by standard, grade, and benchmark — available online at http://www.mcrel.org/standards-benchmarks/

Topic 9: The Sun and Other Stars

Grade Span	Benchmarks	Supporting Documents & Grade Level†
Grade 1	1. Knows that the Sun supplies heat and light to Earth *Std 9, Gr K–2, Bmrk 1**	CA (1) OH (1) SC (1) SD (1)
Grades K–3	2. Knows basic patterns of the Sun and Moon (e.g., the Sun appears every day and the Moon appears sometimes at night and sometimes during the day; the Sun and Moon appear to move from east to west across the sky; the Moon appears to change shape over the course of a month; the Sun's position in the sky changes through the seasons) *Std 3, Gr K–2, Bmrk 1**	CA (3) OH (K,2) SC (1) SD (3)
Grades 3–5	3a. Knows that the patterns of stars in the sky stay the same, although they appear to slowly move from east to west across the sky nightly, and that different stars can be seen in different seasons *Std 3, Gr 3–5, Bmrk 3**	CA (3) OH (5) SC (4) SD (5)
	3b. Knows that the Earth is one of several planets that orbit the Sun and that the Moon orbits the Earth *Std 3, Gr 3–5, Bmrk 2**	CA (3) OH (5) SC (4) SD (3)
Grades 4–8	4. Knows characteristics of the Sun and its position in the universe (e.g., the Sun is a medium-sized star; it is the closest star to Earth; it is the central and largest body in the solar system; it is located at the edge of a disk-shaped galaxy) *Std 3, Gr 6–8, Bmrk 3**	OH (6) SC (8) SD (4)

† State standards document that supports proposed grade sequencing

* Benchmark reference: location within McREL's *Compendium* by standard, grade, and benchmark — available online at http://www.mcrel.org/standards-benchmarks/

Topic 10: The Universe

Grade Span	Benchmarks	Supporting Documents & Grade Level†
Grades 3–5	1a. Knows that the patterns of stars in the sky stay the same, although they appear to slowly move from east to west across the sky nightly, and that different stars can be seen in different seasons *Std 3, Gr 3–5, Bmrk 3**	CA (3) OH (5) SC (4) SD (5)
	1b. Knows that telescopes magnify distant objects in the sky (e.g., the Moon, planets) and dramatically increase the number of stars we can see *Std 3, Gr 3–5, Bmrk 6**	CA (3) OH (5)
	1c. Knows that astronomical objects in space are massive in size and are separated from one another by vast distances (e.g., many stars are more massive than our Sun but so distant they look like points of light) *Std 3, Gr 3–5, Bmrk 5**	OH (5) SD (5)
Grades 8–12	2. Knows that the universe consists of many billions of galaxies (each containing many billions of stars) and that incomprehensible distances (measured in light years) separate these galaxies and stars from one another and from the Earth *Std 3, Gr 6–8, Bmrk 6**	CA (8) OH (8) SC (9–12) SD (8)

† State standards document that supports proposed grade sequencing

* Benchmark reference: location within McREL's *Compendium* by standard, grade, and benchmark — available online at http://www.mcrel.org/standards-benchmarks/

Topic 11: Water in the Earth System

Grade Span	Benchmarks	Supporting Documents & Grade Level†
Grades K–2	1. Knows that water can be a liquid or a solid and can be made to change from one form to the other, but the amount of water stays the same *Std 1, Gr K–2, Bmrk 2**	CA (K) OH (1) SC (2) SD (K)
Grades 2–5	2. Knows that water exists in the air in different forms (e.g., in clouds and fog as tiny droplets; in rain, snow, and hail) and changes from one form to another through various processes (e.g., freezing, condensation, precipitation, evaporation) *Std 1, Gr 3–5, Bmrk 1**	CA (5) OH (4) SC (3,4) SD (2)
Grades 3–7	3a. Knows that most of Earth's surface is covered by water, that most of that water is salt water in oceans, and that fresh water is found in rivers, lakes, underground sources, and glaciers *Std 1, Gr 3–5, Bmrk 4**	CA (5) OH (6,7) SC (6,7)
	3b. Knows the processes involved in the water cycle (e.g., evaporation, condensation, precipitation, surface run-off, percolation) and their effects on climatic patterns *Std 1, Gr 6–8, Bmrk 2**	CA (5) OH (6,7) SC (6) SD (3)

† State standards document that supports proposed grade sequencing

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Topic 12: Characteristics of Organisms

Grade Span	Benchmarks	Supporting Documents & Grade Level†
Grades K–2	1a. Knows that plants and animals closely resemble their parents *Std 4, Gr K–2, Bmrk 1**	CA (2) OH (K) SC (K) SD (K)
	1b. Knows that differences exist among individuals of the same kind of plant or animal *Std 4, Gr K–2, Bmrk 2**	CA (2) OH (K) SC (K) SD (K)
Grades 2–5	2. Knows that many characteristics of an organism are inherited from its parents (e.g., eye color in human beings, fruit or flower color in plants), and that other characteristics result from an individual's interactions with the environment (e.g., people's table manners, ability to ride a bicycle) *Std 4, Gr 3–5, Bmrk 1**	CA (2) OH (4) SC (3,4) SD (5)
Grades 6–7	3. Knows that reproduction is a characteristic of all living things and is essential to the continuation of a species *Std 4, Gr 6–8, Bmrk 1**	OH (6) SC (6,7) SD (7)

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Topic 13: Diversity and Unity Among Organisms

Grade Span	Benchmarks	Supporting Documents & Grade Level†
Grades K–2	1. Knows that there are similarities and differences in the appearance and behavior of plants and animals *Std 7, Gr K–2, Bmrk 2**	CA (K) OH (2) SD (K)
Grades 2–4	2. Knows that fossils can be compared to one another and to living organisms to observe their similarities and differences *Std 7, Gr 3–5, Bmrk 1**	CA (2) SC (3) SD (4)
Grades 7–8	3. Knows evidence that supports the idea that there is unity among organisms despite the fact that some species look very different (e.g., similarity of internal structures in different organisms, similarity of chemical processes in different organisms, evidence of common ancestry) *Std 7, Gr 6–8, Bmrk 4**	CA (7) OH (8) SC (8)

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Topic 14: Interdependence of Organisms

Grade Span	Benchmarks	Supporting Documents & Grade Level†
Grades K–4	1. Knows the organization of simple food chains and food webs (e.g., green plants make their own food with sunlight, water, and air; some animals eat the plants; some animals eat the animals that eat the plants) *Std 6, Gr 3–5, Bmrk 1**	CA (4) OH (3) SC (2) SD (K)
Grades 4–5	2. Knows ways in which organisms interact and depend on one another through food chains and food webs in an ecosystem (e.g., producer/consumer, predator/prey, parasite/host, relationships that are mutually beneficial or competitive) *Std 6, Gr 6–8, Bmrk 3**	CA (4) OH (5) SC (5) SD (5)
Grades 5–6	3. Knows how energy is transferred through food webs in an ecosystem (e.g., energy enters ecosystems as sunlight, and green plants transfer this energy into chemical energy through photosynthesis; this chemical energy is passed from organism to organism; animals get energy from oxidizing their food, releasing some of this energy as heat) *Std 6, Gr 6–8, Bmrk 4**	CA (6) OH (6) SC (5) SD (6)

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Topic 15: Populations and Ecosystems

Grade Span	Benchmarks	Supporting Documents & Grade Level†
Grades 1–4	1. Knows that living things are found almost everywhere in the world and that distinct environments support the life of different types of plants and animals *Std 6, Gr K–2, Bmrk 2**	CA (1) OH (1) SC (4) SD (2)
Grades 4–7	2. Knows that all individuals of a species that exist together at a given place and time make up a population, and that all populations living together and the physical factors with which they interact compose an ecosystem *Std 6, Gr 6–8, Bmrk 1**	CA (4) OH (7) SC (5) SD (4)
Grades 5–7	3. Knows factors that affect the number and types of organisms an ecosystem can support (e.g., available resources; abiotic factors such as quantity of light and water, range of temperatures, and soil composition; disease; competition from other organisms within the ecosystem; predation) *Std 6, Gr 6–8, Bmrk 2**	CA (6) OH (7) SC (5) SD (7)

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Topic 16: Relationships Between Organisms and the Environment

Grade Span	Benchmarks	Supporting Documents & Grade Level†
Grades K–2	1a. Knows the basic needs of plants and animals (e.g., air, water, nutrients, light or food, shelter) *Std 5, Gr K–2, Bmrk 1**	CA (1) OH (K) SC (1,2) SD (K,1)
	1b. Knows that plants and animals need certain resources for energy and growth (e.g., food, water, light, air) *Std 6, Gr K–2, Bmrk 1**	CA (1) OH (2) SC (1) SD (1)
Grades 3–5	2. Knows that changes in the environment can have different effects on different organisms (e.g., some organisms move in, others move out; some organisms survive and reproduce, others die) *Std 6, Gr 3–5, Bmrk 4**	CA (3) OH (4) SC (3) SD (5)
Grades 3–5	3a. Knows that an organism's patterns of behavior are related to the nature of that organism's environment (e.g., kinds and numbers of other organisms present, availability of food and resources, physical characteristics of the environment) *Std 6, Gr 3–5, Bmrk 3**	CA (4) OH (5) SC (4) SD (4)
	3b. Knows that all organisms (including humans) cause changes in their environments, and that these changes can be beneficial or detrimental *Std 6, Gr 3–5, Bmrk 5**	CA (3) OH (5) SC (4)

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Topic 17: Structure and Function in Organisms

Grade Span	Benchmarks	Supporting Documents & Grade Level†
Grades K–2	1. Knows that plants and animals have features that help them live in different environments *Std 5, Gr K–2, Bmrk 2**	CA (1) OH (K,2) SC (1) SD (1)
Grades 3–5	2. Knows that living organisms have distinct structures and body systems that serve specific functions in growth, survival, and reproduction (e.g., various body structures for walking, flying, or swimming) *Std 5, Gr 3–5, Bmrk 2**	CA (3) OH (3,4,5) SC (3) SD (3)
Grades 5–8	3. Knows that multicellular organisms have a variety of specialized cells, tissues, organs, and organ systems that perform specialized functions (e.g., digestion, respiration, reproduction, circulation, excretion, movement, control and coordination, protection from disease) *Std 5, Gr 6–8, Bmrk 4**	CA (5) OH (6) SC (7) SD (7,8)
Grades 5–8	4a. Knows the levels of organization in living systems, including cells, tissues, organs, organ systems, whole organisms, ecosystems, and the complementary nature of structure and function at each level *Std 5, Gr 6–8, Bmrk 3**	CA (7) OH (7) SC (7)
	4b. Knows that organisms have a great variety of body plans and internal structures that serve specific functions for survival (e.g., digestive structures in vertebrates, invertebrates, unicellular organisms, and plants) *Std 5, Gr 6–8, Bmrk 5**	CA (5) OH (7) SC (7) SD (8)

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Topic 18: Chemical Reactions

Grade Span	Benchmarks	Supporting Documents & Grade Level†
Grades 5–7	1a. Knows that substances react chemically in characteristic ways with other substances to form new substances (compounds) with different characteristic properties *Std 8, Gr 6–8, Bmrk 8**	CA (5) OH 7) SC (7) SD (5)
	1b. Knows that one example of oxidation is the combining of oxygen with another substance (e.g., burning, rusting) *Std 8, Gr 6–8, Bmrk 10**	OH (7) SC (7)
Grades 8–12	2. Knows factors that influence reaction rates (e.g., types of substances involved, temperature, concentration of reactant molecules, amount of contact between reactant molecules) *Std 8, Gr 6–8, Bmrk 9**	CA (9–12) OH (8) SC (9–12) SD (8)

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Topic 19: Conservation of Matter and Energy

Grade Span	Benchmarks	Supporting Documents & Grade Level†
Grades 6–7	1. Knows how matter is recycled within ecosystems (e.g., matter is transferred from one organism to another repeatedly, and between organisms and their physical environment; the total amount of matter remains constant, even though its form and location change) *Std 6, Gr 6–8, Bmrk 5**	CA (6) OH (6) SC (7) SD (7)
Grades 7–8	2. Understands the conservation of mass in physical and chemical change (e.g., no matter how substances within a closed system interact with one another, the total weight of the system remains the same; the same number of atoms of a single element weighs the same, no matter how the atoms are arranged) *Std 8, Gr 6–8, Bmrk 6**	CA (8) OH (8) SC (7) SD (7,8)
Grades 7–12	3. Understands the law of conservation of energy (i.e., energy cannot be created or destroyed but only changed from one form to another) *Std 9, Gr 6–8, Bmrk 2**	CA (9–12) OH (8) SC (9–12) SD (7)

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Topic 20: Electricity and Magnetism

Grade Span	Benchmarks	Supporting Documents & Grade Level†
Grades K–2	1. Knows that magnets can be used to make some things move without being touched *Std 10, Gr K–2, Bmrk 1**	CA (2) OH (1) SD (K)
Grades 2–4	2. Knows that magnets attract and repel each other and attract certain kinds of other materials (e.g., iron, steel) *Std 10, Gr 3–5, Bmrk 1**	CA (4) OH (3) SC (2) SD (2)
Grades 4–5	3. Knows the organization of a simple electrical circuit (e.g., battery or generator, wire, a complete loop through which the electrical current can pass) *Std 9, Gr 3–5, Bmrk 3**	CA (4) OH (5) SC (4)
Grade 6	4a. Knows that electrical circuits provide a means of transferring electrical energy to produce heat, light, sound, and chemical changes *Std 9, Gr 6–8, Bmrk 5**	OH (6) SC (6) SD (6)
	4b. Knows that just as electric currents can produce magnetic forces, magnets can cause electric currents *Std 10, Gr 6–8, Bmrk 2**	OH (6) SC (6) SD (6)

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Topic 21: Energy Transfer and Entropy

Grade Span	Benchmarks	Supporting Documents & Grade Level†
Grades 3–6	1. Knows that heat can move from one object to another by conduction and that some materials conduct heat better than others *Std 9, Gr 3–5, Bmrk 2**	CA (6) OH (5) SC (3) SD (5)
Grades 4–6	2. Knows that electrical circuits provide a means of transferring electrical energy to produce heat, light, sound, and chemical changes *Std 9, Gr 6–8, Bmrk 5**	CA (4) OH (6) SC (6) SD (6)
Grades 6–8	3. Knows that heat energy flows from warmer materials or regions to cooler ones through conduction, convection, and radiation *Std 9, Gr 6–8, Bmrk 3**	CA (6) OH (8) SC (6) SD (7)

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Topic 22: Forces and Motion

Grade Span	Benchmarks	Supporting Documents & Grade Level†
Grades K–2	1. Knows that the position and motion of an object can be changed by pushing or pulling *Std 10, Gr K–2, Bmrk 4**	CA (2) OH (K) SC (1) SD (1)
Grades 2–3	2a. Knows that when a force is applied to an object, the object either speeds up, slows down, or goes in a different direction *Std 10, Gr 3–5, Bmrk 5**	OH (3) SD (2)
	2b. Knows the relationship between the strength of a force and its effect on an object (e.g., the greater the force, the greater the change in motion; the more massive the object, the smaller the effect of a given force) *Std 10, Gr 3–5, Bmrk 6**	CA (2) OH (3) SD (2)
Grades 5–8	3. Understands effects of balanced and unbalanced forces on an object's motion (e.g., if more than one force acts on an object along a straight line, then the forces will reinforce or cancel one another, depending on their direction and magnitude; unbalanced forces such as friction will cause changes in the speed or direction on an object's motion) *Std 10, Gr 6–8, Bmrk 4**	CA (8) OH (7) SC (5,6) SD (6,8)

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Topic 23: Forms of Energy (Heat Energy)

Grade Span	Benchmarks	Supporting Documents & Grade Level†
Grades K–6	1a. Knows that heat can be produced in many ways (e.g., burning, rubbing, mixing substances together) *Std 9, Gr K–2, Bmrk 2**	OH (5) SC (3) SD (K)
	1b. Knows that heat can move from one object to another by conduction and that some materials conduct heat better than others *Std 9, Gr 3–5, Bmrk 2**	CA (6) OH (5) SC (3)
Grades 5–8	2a. Knows that energy is a property of many substances (e.g., heat energy is the disorderly motion of molecules and in radiation; chemical energy is in the arrangement of atoms; mechanical energy is in moving bodies or in elastically distorted shapes; electrical energy is in the attraction or repulsion between charges) *Std 9, Gr 6–8, Bmrk 1**	OH (8) SC (6) SD (5)
	2b. Knows that heat energy flows from warmer materials or regions to cooler ones through conduction, convection, and radiation *Std 9, Gr 6–8, Bmrk 3**	CA (6) OH (8) SC (6) SD (7)

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Topic 24: Forms of Energy (Light Energy)

Grade Span	Benchmarks	Supporting Documents & Grade Level†
Grades 2–5	1a. Knows that light travels in a straight line until it strikes an object *Std 9, Gr K–2, Bmrk 5**	CA (3) OH (2) SC (4) SD (2)
	1b. Knows that light can be reflected, refracted, or absorbed *Std 9, Gr 3–5, Bmrk 4**	CA (3) OH (5) SC (4)
Grades 5–8	2a. Knows ways in which light interacts with matter (e.g., transmission, including refraction; absorption; scattering, including reflection) *Std 9, Gr 6–8, Bmrk 8**	CA (7) SC (8) SD (5)
	2b. Knows that only a narrow range of wavelengths of electromagnetic radiation can be seen by the human eye; differences of wavelength within that range of visible light are perceived as differences in color *Std 9, Gr 6–8, Bmrk 9**	CA (7) OH (6) SC (8) SD (5)

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Topic 25: Position and Motion

Grade Span	Benchmarks	Supporting Documents & Grade Level†
Grades K–2	1a. Knows that things move in many different ways (e.g., straight line, zigzag, vibration, circular motion) *Std 10, Gr K–2, Bmrk 5**	OH (K) SC (1) SD (1)
	1b. Knows that the position and motion of an object can be changed by pushing or pulling *Std 10, Gr K–2, Bmrk 4**	CA (2) OH (K) SC (1) SD (1)
Grades 5–8	2. Knows that an object's motion can be described and represented graphically according to its position, direction of motion, and speed *Std 10, Gr 6–8, Bmrk 3**	CA (8) OH (7) SC (5) SD (6)

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Topic 26: Properties of Substances

Grade Span	Benchmarks	Supporting Documents & Grade Level†
Grades K–1	1. Knows that different objects are made up of many different types of materials (e.g., cloth, paper, wood, metal) and have many different observable properties (e.g., color, size, shape, weight) *Std 8, Gr K–2, Bmrk 1**	CA (K) OH (K) SC (1) SD (K)
Grades K–2	2. Knows that things can be done to materials to change some of their properties (e.g., heating, freezing, mixing, cutting, dissolving, bending), but that not all materials respond the same way to what is done to them *Std 8, Gr K–2, Bmrk 2**	CA (1) OH (2) SD (K)
Grade 3	3. Knows that materials may be composed of parts that are too small to be seen without magnification *Std 8, Gr 3–5, Bmrk 4**	CA (3) OH (3) SD (3)
Grades 3–6	4. Knows that substances can be classified by their physical and chemical properties (e.g., magnetism, conductivity, density, solubility, boiling and melting points) *Std 8, Gr 3–5, Bmrk 3**	CA (5) OH (3) SC (6) SD (5)
Grades 5–7	5a. Knows that substances containing only one kind of atom are elements and do not break down by normal laboratory reactions (e.g., heating, exposure to electric current, reaction with acids); over 100 different elements exist *Std 8, Gr 6–8, Bmrk 4**	CA (5) OH (7) SC (6) SD (6)
	5b. Knows that many elements can be grouped according to similar properties (e.g., highly reactive metals, less-reactive metals, highly reactive nonmetals, almost completely non-reactive gases) *Std 8, Gr 6–8, Bmrk 5**	OH (7) SC (6) SD (6)

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BIBLIOGRAPHY

American Association for the Advancement of Science. (2001). *Atlas of science literacy.* Washington, DC: AAAS and the National Science Teachers Association.

American Association for the Advancement of Science. (1993). *Benchmarks for science literacy.* Washington, DC: Author.

American Federation of Teachers. (2001). *Making standards matter.* Washington, DC: Author. Retrieved May 11, 2001, from http://www.aft.org/edissues/standards/MSM2001/Index.htm

California State Board of Education. (1998, February 2). *Science content standards grades K–12* (prepublication ed.). Sacramento, CA: Author. Retrieved June 17, 1999, from http://www.cde.ca.gov/board/science.html

Kendall, J. S. (2000). Topics: A roadmap to standards. *NASSP Bulletin, 84*(620), 37–48.

Kendall, J. S., & Marzano, R. J. (2000). *Content knowledge: A compendium of standards and benchmarks for K–12 education* (3rd ed.). Reston, VA: Association for Supervision and Curriculum Development.

Lerner, L. S. (2000). The state of state standards in science. In C. E. Finn, Jr., & M. J. Petrilli (Eds.), *The state of state standards*. Fordham Foundation. Retrieved from http://www.fordhamfoundation.org/library/soss2000/2000soss.html

Ohio Department of Education. (Draft, 2001). Ohio's Model Competency-Based Science Program. Columbus, OH: Ohio Department of Education.

South Carolina State Department of Education. (2000) K–8 Science Standards. Retrieved from http://www.myscschools.com/offices/cso/Science/Sciencest.htm

South Dakota Department of Education and Cultural Affairs. (1998, December). *South Dakota content standards: Mathematics*. Retrieved from http://www.state.sd.us/deca/TA/contentstandards/math/index.htm

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